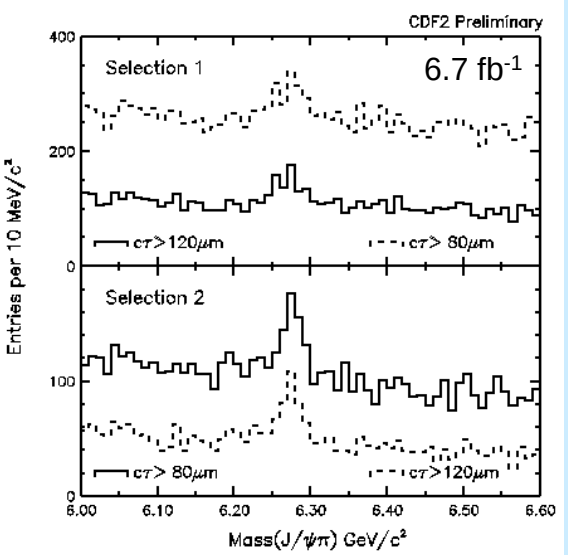
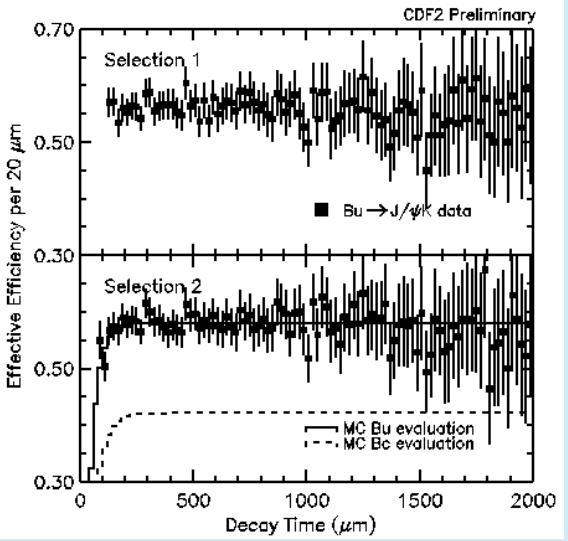
$B_c \to J/\psi\,\pi$ Lifetime measurement

- Use 6.7 fb^{-1} and try two independent approaches
  - Selection 1: no dependence of selection on decay time
    - Fit fixes bkgd determined from sideband region
  - Selection 2: better S/N, but decay time dependence
    - Fit procedure uses sideband background parameters as a Gaussian constraint before fitting signal region
    - Requires MC input on the decay time dependence

Selection variable	selection 1	selection 2
$P_T(\pi)$	> 2.0 GeV/c	> 2.0 GeV/c
$P_T(J/\psi\ \pi)$	> 6.5 GeV/c	> 6.5 GeV/c
$Prob(\chi^2_{\rm CTVMFT})$	$> 0.01\%$	$> 0.1\%$
$\sigma[M(J/\psi\pi)]$	-	< 40 MeV/c^2
$\sigma[c\tau(J/\psi\ \pi)]$	$< 100\ \mu$m	$< Max[35, 65 - 3 \times P_T(\mathrm{B})\mathrm{GeV}/c]\ \mu$m
2D Pointing angle, β_T	-	< 0.2 radians
$\lvert ip_{\rm signif}(J/\psi\pi$ wrt p.v.$)\rvert$	$< 2.0\ \sigma$	$< 2.0\ \sigma$
Track isolation (cone=0.7)	< 0.6	< 0.6
$c\tau_{\rm MIN}(J/\psi\ \pi)$	$> 120\ \mu$m	$> 80\ \mu$m

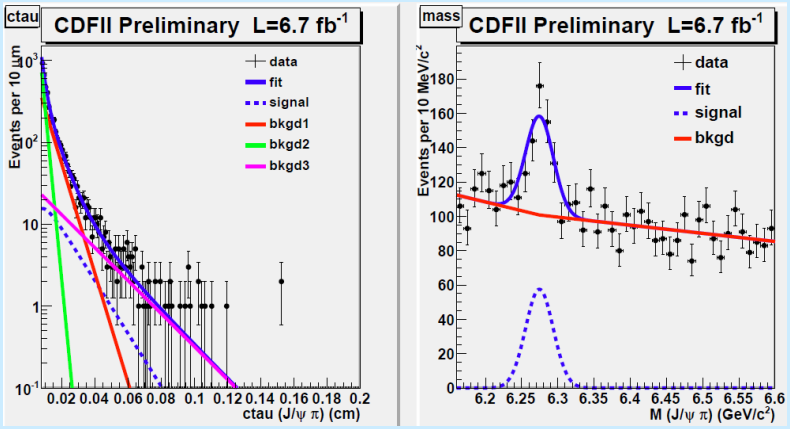




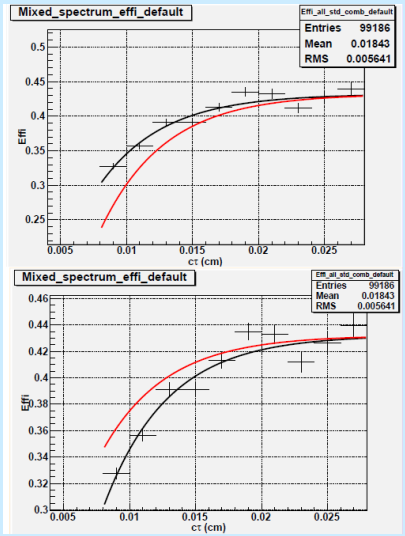
Use the selection 2 result as the central value (selection 1 serves as a cross-check)

Systematic uncertainties

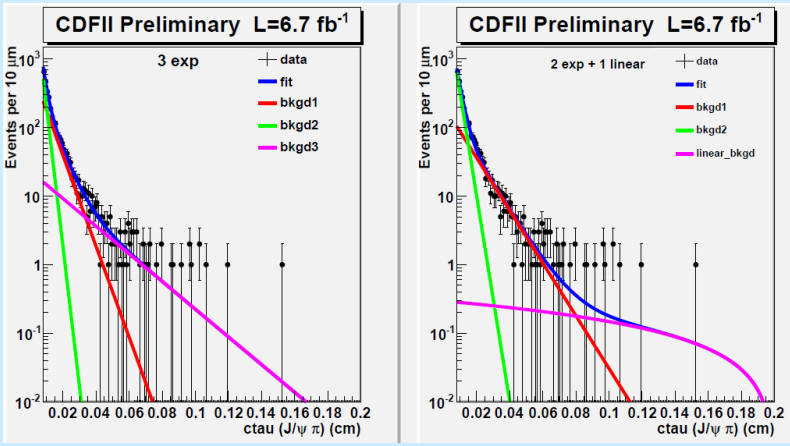
- Vary models of the efficiency vs decay time and the models of background mass and decay time distributions



Vary bkgd mass model => 5μm effect



Vary eff vs decay time ⇒3μm effect

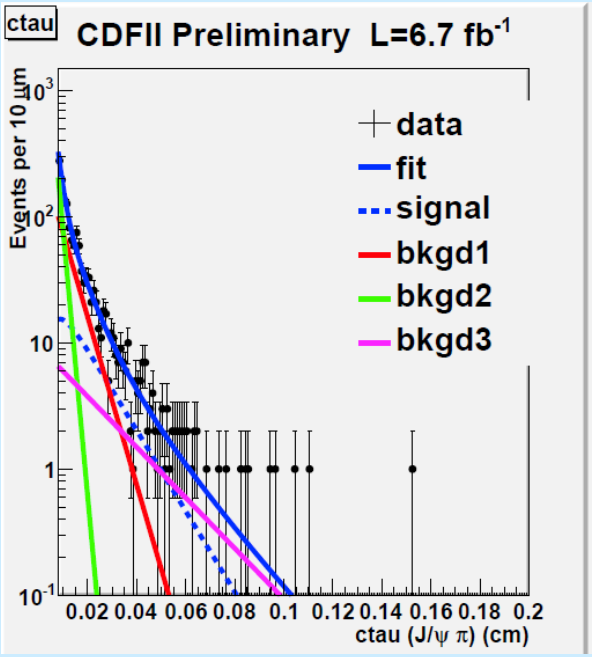


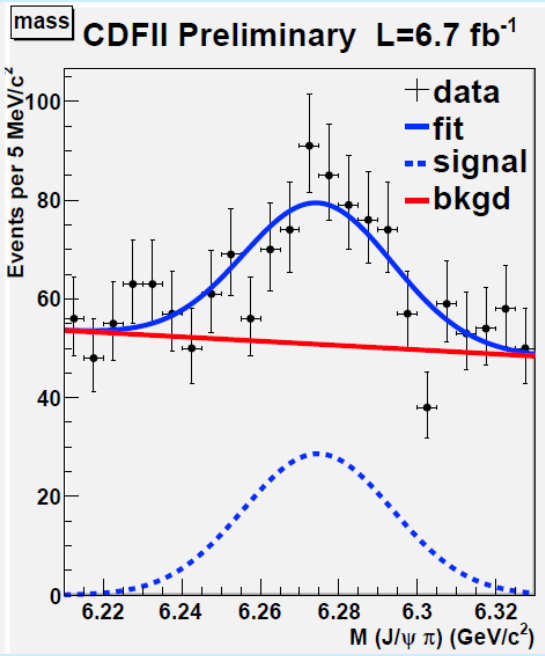
Vary bkgd decay time model => 4μm effect

Systematic	Selection 2
Calibration	2
Signal Mass Model	1
Signal Decay Time Model	3
Background Mass Model	5
Background Decay Time Model	4
Fitting Method	1
Other Tests	3
Total	8

Results

Fit $L = \prod_i \left[f_s \cdot M_s(m_i, \sigma_{mi}) \cdot T_s(c\tau_i) + (1 - f_s) \cdot M_b(m_i) \cdot T_b(c\tau_i) \right]$ and project in decay time and mass





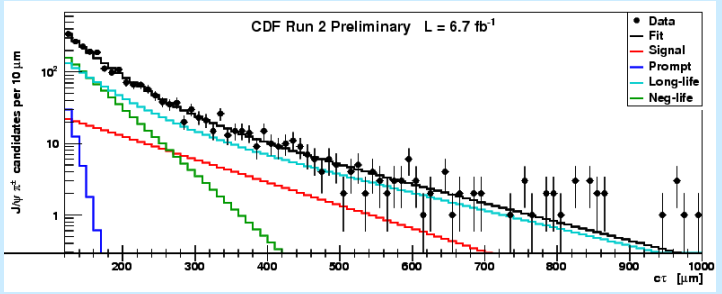
Signal mass: Gaussian resolution
Signal decay time: exponential convoluted with resolution
Bkgd mass: Linear sideband
Bkgd decay time: 3 exponentials fitted above 80μm

Use background parameters from the sideband as a Gaussian constraint in the fit over the signal mass region.

$$\tau(B_c^-) = (0.452 \pm 0.048 \pm 0.027) \text{ ps}$$

$$c\tau(B_c^-) = (136 \pm 14 \pm 8) \ \mu\text{m}$$

Selection 1 cross-check result:



$$c\tau(B_c^-) = (135 \pm 16 \pm 10) \ \mu\text{m}$$